Sciaenid Resources in the Gulf of Mexico

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The family Sciaenidae consists of 150 to 200 species of fishes, which occur in fresh, brackish, and marine waters in temperate and tropical regions of the world. At least 18 species occur in the Gulf of Mexico (Hoese and Moore 1977), and 10 of these are important to recreational and commercial fishermen. These are the Atlantic croaker *(Micropogonias undulatus)*. spotted seatrout *(Cynoscion nebulosus)*, sand seatrout *(Cynoscion arenarius*, also called white seatrout), silver seatrout *(Cynoscion nothus)*, red drum *(Sciaenops ocellatus)*, black drum *(Pogonias cromis)*, spot *(Leiostomus xanthurus)*. southern kingfish *(Menticirrhus americanus)*, gulf kingfish *(Menticirrhus littoralis)*, and silver perch *(Bairdiella chrysoura)*.

In this overview of sciaenid resources of the Gulf of Mexico, the following topics are briefly reviewed: fisheries, biology, ecology, economic value, and sociopolitics.

Fisheries

Recreational

In the recreational fisheries of the Gulf, many sciaenids rank highly when examined from the standpoint of species that are caught and species that are sought. Rankings of sciaenid catches as determined in national surveys (Tables 1 and 2) show clearly the high incidence and high perference of sciaenids, especially the spotted seatrout.

The importance of spotted seatrout, as determined by rankings, has also been highlighted

Table 1. Rankings of sciaenids among fishes caught by recreational anglers in the Gulf of Mexico (dashes indicate no listing)

	1960		1965		1970		1979	
Species	By number	By weight	By number	By weight	By number	By weight	By number	By weight
Atlantic croaker	2	7	2	8	1	2	3	12
Black drum	9	10	15	6	9	6	13	8
Red drum	4	4	7	2	8	3	7	6
Drums	-	-	-	-	-	-	38	25
Kingfishes	7	13	10	6	7	10	9	20
Silver perch	-	-	-	-	-	-	20	37
Seatrouts	1	1	-	-	-	-	-	-
Sand seatrout	-	-	4	3	4	5	5	5
Silver seatrout	-	-	-	-	-	-	43	39
Spotted seatrout	-	-	1	1	2	1	2	1
Spot	-	-	-	-	-	-	26	34
Number of reported species	29		32		38		64	55

Determined from Clark (1962), Deuel (1973), Deuel and Clark (1968), and U.S. Department of Commerce (1980).

Table 2. Rankings of sciaenids among fishes sought by recreational anglers in the Gulf of Mexico (dashes indicate no listing)

Species	Angler survey 1979[1]	Boat anglers in estuaries of gulf[2] Private recreational boats	Boat anglers in estuaries of gulf[2] Commercial sportfishing boats	Boat anglers in open waters of gulf[2] Private recreational boats	Boat anglers in open waters of gulf[2] Commercial sportfishing boats
Atlantic croaker	-	9	-	29	-
Black drum	-	4	4	24	7
Red drum	2	2	5	6	8
Drums	8	-	-	-	-
Kingfishes	14	25	-	10	5
Sand seatrout	9	17	3	21	-
Spotted seatrout	1	1	2	7	9
Unspecified trout	-	6	9	1	-
Number of reported species	14	30	9	29	19

1/ Determined from U.S. Department of Commerce (1980).

2/ Determined from Bromberg (1973).

in the results of surveys of recreational fishing in various locations of the Gulf Coast (Davis 1980, Fontenot and Rogillio 1970, Higman 1967, Irby 1974, Jackson 1972, Johansen and Kemp 1979, McIlwain 1978, More 1965, Rogillio 1975, Sutherland 1977, Wade 1977). Red drum was also important. In some bay stystems of Texas, black drum, Atlantic croaker, and sand seatrout have been found to be important (McEachron 1980b).

Recreational catch and effort data have been obtained in sectors of the Gulf Coast by various agencies. Perret et al. (1980) have summarized calculations of catch per unit of effort (fish per hour, pounds per hour) of available recreational fishing data from the Gulf Coast for spotted seatrout and red drum. They partitioned the data by seasons and by state and were careful to describe the limitations of the data. The best available data from the standpoint of statewide coverage and of long term coverage were those collected by the Texas Parks and Wildlife Department (Breuer et al. 1977, Heffernan et al. 1977, McEachron 1980a, 1980b). Data from creel censuses of recreational boat anglers have been collected since 1974 (data from commercial fisheries were collected also). The results showed that in Texas for spotted seatrout, the annual mean (± standard deviation) number of fish caught per hour was 0.30 ± 0.08 and the annual mean pounds of fish caught per hour was 0.28 ± 0.05. For red drum, the comparable values were 0.04 ± 0.02 and 0.08 ± 0.03, respectively (Perret et al. 1980).

A sciaenid that is becoming increasingly popular as a target species by recreational fishermen, especially around oil rigs in Louisiana, is the Atlantic croaker (Sebastian 1976). Also, the Atlantic croaker and sand seatrout are used as live bait to catch king mackerel *(Scomberomorus cavalla)* by drift fishing near these rigs (Duffy 1980).

In general, recreational fishermen catch sciaenids while angling from shores, bridges, piers, and boats. Large varieties of baits, lures, and fishing techniques are used by the anglers.

Commercial

Sciaenid resources support two major commercial fisheries in the Gulf, one (industrial fish) concerned with the production of pet food, and the other with the production of food fish. Comparison of sciaenids among commercial fishes landed in the Gulf again show relatively high rankings for many species (Table 3). Spotted seatrout and red drum have historically been relatively important from the standpoint of both landings and ex-vessel values, whereas Atlantic croaker has become important within the past decade. Black drum, kingfishes, and sand seatrout have also been relatively important, black drum and kingfishes more so in earlier years, and

Table 3. Rankings of sciaenids among fishes in commercial fisheries of the Gulf of Mexico

	1960		1965		1970		1975	
Species	By weight	By value	By weight	By value	By weight	By value	By weight	By value
Atlantic croaker	35	36	38	38	6	9	3	7
Black drum	9	11	12	13	14	15	15	16
Red drum	8	9	11	9	9	10	9	8
Kingfishes	12	17	9	14	12	18	19	26
Sand seatrout	28	30	25	23	15	19	12	14
Spotted seatrout	7	5	6	5	7	5	6	5
Spot	25	27	26	26	30	31	30	41
Number of reported species	59		59		61		64	

Determined from Lyles (1967), Pileggi and Thompson (1978), Power (1962), Wheeland (1973).

sand seatrout more so in later years.

Commercial landings of sciaenids show considerable fluctuations for some species (Table 4). Landings of Atlantic croaker have fluctuated greatly owing to the combination of landings of Atlantic croaker as food fish and as industrial fish in some years while not in other years (C.M. Roithmayr, Natl. Mar. Fish. Serv., personal communication Dec. 1980). The reported landings for this species in the 1970s, however, represent only food fish.

Industrial fish, over half of which consists of Atlantic croaker (Roithmayr 1965), are used primarily for pet food. These fish are caught by trawlers, mostly in waters off Alabama, Mississippi, and Louisiana. Sixty-seven families of fishes have been identified in industrial-fish catches by Roithmayr (1965). He identified 14 species of sciaenids, four of which comprised 75 percent of the total landings during 1950 through 1963. These four were Atlantic croaker, spot, sand seatrout, and silver seatrout. The industrial foodfish production of Atlantic croaker in the northern Gulf of Mexico has been reviewed by Gutherz et al. (1975).

Both domestic and foreign markets have been sought for croaker products. Recently, croaker has been used in the manufacture of a minced-meat product called surimi. Surimi is used to make kamaboko, a fish-jell product popularly eaten by Japanese, both abroad and in the United States. A company in Alabama has been developing this product, using Atlantic croaker of 8 to 10 inches in length. This company has obtained federal funds (Saltonstall-Kennedy funds) to continue developing surimi and finding markets for it (J.E. Greenfield, Natl. Mar. Fish. Serv., personal communication Dec. 1980).

Commercial fishermen use trawl, haul seine, gill net, trammel net, trot line, and hook and line to catch sciaenids. The type of gear used is governed primarily by state and county laws. Descriptions of gear and the employment of the gear have been provided by Perret et al. (1980) and by the Gulf of Mexico Fishery Management Council (1980).

Biology

In general, the life cycle of the 10 sciaenids is as follows. Spawning occurs in the Gulf, usually just beyond the passes leading from estuaries into the Gulf. Some species (seatrouts, black drum, silver perch) have been reported to spawn in estuaries (Mahadevan 1980, Simmons and Breuer 1962). After the pelagic eggs hatch, the oceanic larvae may remain in the Gulf or drift into estuaries. Juveniles use the coastal and estuarine areas as nursery grounds where they feed on molluscs, crustaceans, polychaetes, and fish larvae and where they grow to maturity. When winter approaches, the adult fishes move into deeper waters of estuaries or into the Gulf.

The availability of information, rather than the information itself, on various aspects of preadult and adult life history of the 10 sciaenids was summarized (Tables 5 and 6). Major sources of information were found in Austin et al. (1978), DeVries (1979), Gulf of Mexico Fishery

Table 4. Commercial landings (thousands pounds) of sciaenids in the Gulf of Mexico

Year	Atlantic croaker	Black drum	Red drum	Spotted seatrout	Sand seatrout	Kingfishes	Spot
1976	8,218	2,764	5,308	5,883	1,769	572	113
1975	12,795	1,523	4,387	6,247	2,593	883	214
1974	14,539	1,920	4,756	7,040	2,240	1,061	292
1973	16,609	1,928	4,074	7,440	2,025	1,406	402
1972	11,882	1,868	3,333	5,814	1,506	1,653	366
1971	10,234	1,769	3,514	5,100	1,555	1,550	543
1970	7,435	1,344	3,147	4,925	1,253	1,596	336
1969	5,255	1,308	2,602	4,631	1,174	1,743	355
1968	3,373	1,212	2,604	5,924	881	1,964	374
1967	770	1,441	2,022	5,041	624	2,180	319
1966	308	1,343	2,017	5,521	543	2,163	388
1965	67	1,766	1,842	5,511[1/]		1,906	338
1964	88	1,866	1,527	4,480		1,855	379
1963	172	1,834	2,198	4,569		1,209	405
1962	107	1,764	2,662	4,371		1,170	316
1961	77	2,123	2,208	4,725		1,164	264
1960	79	1,918	1,998	4,798		763	275
1959	187	1,621	2,232	5,059		976	291
1958	5,060	1,414	1,798	5,228		1,051	185
1957	79	1,771	1,588	4,448		754	142
1956	40,269	2,113	1,932	5,060		902	1,371
1955	33,202	2,165	1,668	5,576		1,107	559
1954	23,158	2,307	1,824	4,991		1,089	397
1953	83	912	1,418	4,767		1,946	2,904
1952	2,193	885	1,321	5,228		1,567	1,342
1951	121	992	1,615	4,654		799	216
1950	92	978	2,032	4,882		611	307

1/ Spotted seatrout and white seatrout were combined before 1966.

Data from Lyles (1967 1968 1969), National Marine Fisheries Service (1971), Pileggi and Thompson (1976 1978 1980), Thompson (1974), Wheeland (1972 1973 1975), Wise and Thompson (1977).

Management Council (1980), Herke (1977), Johnson (1978), Moffett et al. (1979), Nakamura et al. (1980), Perret et al. (1980), Powles and Stender (1978), Shlossman (1980), and Williams et al. (1980). All have excellent bibliographies.

As shown in Tables 5 and 6, considerable amounts of information were available for most of the species. Information on parasitology and physiology of these species was also available but was not considered herein. Biomass estimates have been made for only two species, Atlantic croaker in the north central Gulf (Juhl et al. 1975, Juhl et al. 1976) and spotted seatrout in south Florida (Iversen and Moffett 1962). Population estimates (number of fish and number per acre) for black drum, red drum, and spotted seatrout in various bays of Texas have been made by Matlock and Weaver (1979a, 1979b). Yield models for Atlantic croaker in the northern Gulf have been developed by Chittenden (1977).

Table 5. Availability (+) of information on pre-adult life of sciaenids in the Gulf of Mexico. (Information in some instances is from specific areas of the Gulf Coast)

Species	Description of Egg	Larva	Juvenile	Growth	Maturation size	Distribution	Habitat
Atlantic croaker		+	+	+	+	+	+
Spotted seatrout	+	+	+	+	+	+	+
Sand seatrout		+	+	+	+	+	+
Silver seatrout		+	+	+	+	+	+
Red drum	+	+	+	+	+	+	+
Black drum	+	+	+	+	+	+	+
Spot		+	+	+	+	+	+
Southern kingfish		+	+	+	+	+	+
Gulf kingfish			+	+		+	+
Silver perch	+	+	+	+	+	+	+

Ecology

Estuarine ecosystems and their roles as nurseries for sciaenids and other species have been discussed by numerous authors (e.g., Gunter 1967, Skud and Wilson 1960, Sykes 1968, 1971, Sykes and Finucane 1966, and Tabb 1966). Great concern has been expressed about the adverse impact upon these species by alterations and pollution of estuaries by man (Arnold 1967, Lindall 1973, Lindall and Saloman 1977, Odum 1970). Some of the factors causing concern are dredging and filling, alterations of freshwater inflow, pollution from domestic, agricultural, and industrial development, and alterations and pollution from oil and gas explorations. The impact of such activities and procedures to minimize biological and environmental damage has been discussed by several authors (e.g., papers in EPA 1977, papers in Fore and Peterson 1980, Lindall and Trent 1975, Linton and Cooper 1971, Livingston et al. 1975).

Dredging and filling, alteration of freshwater inflow, and pollution can have insidious effects on estuarine organisms, as described by Odum (1970). Dredging and alteration of freshwater inflow can adversely affect the supply of detritus, which has been found to be important in estuarine food webs (Gulf South Research Insti-

Table 6. Availability (+) of information on adult life of scianids in the Gulf of Mexico. (Information in some instances is from specific areas of the Gulf Coast)

Species	Age and growth	Food	Fecundity	Spawning	Migration and movements	Distribution and abundance	Habitat
Atlantic croaker	+	+	+	+	+	+	+
Spotted seatrout	+	+	+	+	+	+	+
Sand seatrout	+	+	+	+	+	+	+
Silver seatrout	+		+	+		+	+
Red drum	+	+	+	+	+	+	+
Black drum	+	+	+	+	+	+	+
Spot	+	+	+	+	+	+	+
Southern kingfish				+		+	+
Gulf kingfish				+		+	+
Silver perch	+	+	+	+	+	+	+

tute 1977, Heald 1971, Livingston 1979, Odum 1971). Pollutants can have subtle effects by making organisms more vulnerable to predation and reproduction less successful.

Some sciaenids take advantage of man's alterations in estuaries. Spotted seatrout and Atlantic croaker use the deep holes that have been dredged in estuaries as refuges during cold weather, a behavioral trait that has not gone unrecognized by anglers. Young sciaenids find easier ingress and egress to nursery grounds via some of the channels that have been deepened or created by dredging. Juvenile and adult sciaenids benefit during winter from hot water effluents (thermal pollution) of power plants (Gallaway and Strawn 1974), but on the other hand the copious amounts of water required for cooling cause high mortalities of sciaenid eggs and larvae (Mahadevan 1980).

Natural environmental factors also have serious impacts on sciaenid stocks. Red tides, cold weather, and floods have been reported to cause mass mortalities. When the red tide, caused by blooms of at least two species of dinoflagellates, *Ptychodiscus brevis* and *Gonyaulax monilata*, occurs along the coast, local stocks of fishes, including sciaenids, can suffer heavy mortalities (Springer and Woodburn 1960, K.S. Steidinger, Fl. Dep. Nat. Resour., personal communication Dec. 1980). Cold weather can cause heavy mortalities, particularly when the temperature drops suddenly and remains low for several days (Gunter and Hildebrand 1951). Floods, especially when accompanied by low temperatures, can cause mortalities and greater susceptibility to predation in young sciaenids and can also decrease the success of spawning (Adkins et al. 1979).

The effects of hurricanes on sciaenid stocks have not been too severe. For example, Tabb and Jones (1962) reported minor mortalities of spotted seatrout and black drum after a hurricane in the Florida Everglades. Reid (1954) listed spot as one of 17 species of fishes that were conspicuous among dead fishes on a beach in Cedar Key, Florida, following a hurricane. Breder (1962) reported an increase in abundance of spot and the presence of young red drum in contrast to their previous absence in a Florida West Coast bay after a hurricane.

Economic Value

The economic value of sciaenid fisheries in the Gulf of Mexico is difficult to determine for the various reasons described for fisheries in general by numerous authors (e.g., Bell 1978, papers in Stroud and Clepper 1976). The nature of the sciaenid fisheries in the Gulf is such that recreational and commercial fishermen do not fish full-time, or do not fish only, for sciaenids, although some commercial trotline fishermen in Texas are essentially full-time sciaenid fishermen. The same equipment and gear are used for catching other species. Laws governing sciaenid fisheries are not uniform among states, and in some states the laws are not uniform among counties. Variability in regulations affects types of gear, time and location of fishing, and the attendant operational costs and earnings (Perret et al. 1980).

Information on annual values of commercial landings based on ex-vessel prices and information on annual expenditures by recreational fishermen are available (comparability of ex-vessel values and expenditures is not implied). For the commercial fisheries, when data for all species of sciaenids are combined, the landings values show an increase from over $1.5 million in 1960 to over $6 million in 1975 (Table 7). For the recreational fisheries, average annual expenditures by anglers multiplied by numbers of anglers who caught sciaenids yield total annual expenditures by sciaenid anglers of over $219 million in 1960 and over $611 million in 1970 (Table 8). (Since some of the anglers probably were not seeking sciaenids, these calculations represent maximum estimates of expenditures.)

The recreational expenditures appear to be overestimated until comparisons are made with

Table 7. Values of commercial landings of sciaenids in the Gulf of Mexico

Year	Landings (1,000 lb)	Ex-vessel value ($1,000)	Average ex-vessel price ($/lb)
1960	9,556	1,528	0.160
1965	11,092	1,919	0.173
1970	19,700	3,270	0.166
1975	28,378	6,107	0.215

Data from Lyles (1967), Power (1962), and Wheeland (1973).

Table 8. Expenditures by sciaenid anglers in the Gulf of Mexico

Year	Number of sciaenid anglers[1]	Average annual expenditure per angler[2] ($)	Total expenditure ($)
1960	2,181,000	100.81	219,866,610
1965	2,658,000	84.50	224,601,000
1970	3,432,000	178.10	611,239,200

1/ Data from Clark (1962), Deuel (1973), and Deuel and Clark (1968).

2/ Data from U.S. Fish and Wildlife Service (1961, 1966, 1972).

other estimates. For example, Bell (1979) estimated that over $851 million were spent by marine recreational anglers in the entire state of Florida in 1975. M.F. Osborn (Tex. Parks Wildl. Dep., personal communication Jan. 1981) estimated that over $219 million were spent by marine recreational fishermen in Texas during September 1978 through August 1979. Considering that Bell's study involved both the Atlantic and Gulf coasts of Florida, that both Bell's and Osborn's estimates were for all marine recreational anglers, and that three other Gulf states are unaccounted, the computed expenditures in Table 8 do not appear to be unreasonable.

M.F. Osborn (Tex. Parks Wildl. Dep., personal communication Jan. 1981) has made estimates of the economic value of commercial fisheries in Texas by multiplying the value of ex-vessel landings by an indirect gross business mulitplier, which she obtained from the Texas Department of Water Resources. For the period September 1978 through August 1979, the value of ex-vessel landings of spotted seatrout, red drum, black drum, sand seatrout, and Atlantic croaker was $2.2 million. This was multiplied by 2.12. The resulting economic value of the commercial fisheries for sciaenids in Texas was estimated as $4.7 million.

Perret et al. (1980) state that Mexican importations of spotted seatrout and red drum have an economic impact on markets that are supplied by the landings in Texas and Louisiana. They provide data on amounts that were imported from 1950 to 1977. For spotted seatrout, Mexican imports ranged from 129,000 pounds in 1967 to 1,704,000 pounds in 1959. For red drum, the imports ranged from 9,000 pounds in 1967 to 874,000 pounds in 1960. As a comparison between Texas-Louisiana landings and Mexican imports, the averages for the 10-year period of 1966-1975 were as follows: for spotted seatrout, 2,876,000 pounds landed in Texas-Louisiana and 683,000 pounds imported; for red drum, 2,343,000 pounds landed and 482,000 pounds imported.

Sociopolitics

As in many other fisheries, conflicts between recreational and commercial fishermen have occurred in sciaenid fisheries. Generally, recreational interests have applied political pressure on fishery managers and legislators to obtain restrictions on fishing activities of the commercial fishermen. The sciaenid fisheries in the Gulf have experienced these pressures since the late 1800s (Heffernan and Kemp 1980, Matlock 1980). Political pressure from both recreational and commercial fishermen is likely to occur in the future owing to increasing fishing pressure on the stocks, increasing human populations, increasing numbers of older citizens, and increasing tourism along the Gulf Coast (Nakamura in press).

The population in coastal counties of the five Gulf states in the year 2000 has been projected to increase by more than 70 percent over the 1970 population (Table 9). Many of these new residents will be older citizens who will have more leisure time. It is probable that many of these people will fish and, since sciaenid resources will be both desirable and accessible, they will fish for sciaenids. That they can exert considerable fishing mortalities on sciaenids has been shown by Fable and Saloman (1974). In St. Petersburg, Florida, 44 percent of the anglers fishing from piers were 60 years old or older. Of the 10 most frequently angler-caught fishes, five were sciaenids; the most frequently caught species was the silver perch.

Tourism, which is promoted by state, county, and municipal agencies along the Gulf Coast, often focuses on marine recreation, a significant aspect of which is fishing. In this regard, the number of fishing tournaments along the Gulf Coast has increased over the years. Although information on sciaenid tournaments is not available, the number of billfish tournaments may serve as an indication. The number of billfish tournaments increased from 6 in 1972 to over 25 in 1980, more than a four-fold increase in eight years (P.J. Pristas, Natl. Mar. Fish. Serv.,

Table 9. Projections of populations in coastal counties of Gulf states for the year 2000

State	Population in coastal counties in 1970[1/]	Projected population in coastal counties in 2000
Florida West Coast	2,076,214	4,460,800[2/]
Alabama	376,690	520,000[3/]
Mississippi	239,944	382,600[4/]
Louisiana	2,128,966	2,957,700[5/]
Texas	2,992,016	5,219,400[6/]
TOTAL	7,813,830	13,540,500

1/ From U.S. Census 1970.

2/ From Bureau of Economic and Business Research, Univ. Fla.

3/ From South Alabama Regional Planning Commission, Mobile, Ala.

4/ From U.S. Dep. Int., BLM, FWS, Biol. Serv. Prog., FWS/OBS-79/05, March 1980.

5/ From Division of Business and Economic Research, Coll. Bus. Admin., Univ. New Orleans.

6/ From Texas Water Development Board, Austin, Tex.

personal communication Dec. 1980).

Summary

Sciaenid resources in the Gulf of Mexico are extremely important, both recreationally and commercially. The most important species are the spotted seatrout, red drum, and Atlantic croaker. A large amount of information is available on the biology of the more commonly caught sciaenids of the Gulf.

Much concern exists about man's activities and the impact of these activities on the essential habitats of sciaenids, particularly on estuaries that serve as nurseries for the young stages. Dredging and filling, alteration of freshwater inflow, and pollution are the three most destructive activities.

Economically, sciaenid resources are difficult to assess. Values of commercial landings based on ex-vessel prices exceeded $6 million in 1975. Expenditures of sciaenid anglers exceeded $611 million in 1970. Recreational interests have historically caused restrictions on commercial fishing. Increasing populations along the Gulf Coast, increasing promotions of tourism to the Gulf Coast, and increasing fishing pressure from both recreational and commercial fishermen will require resource managers and legislators in the future to enact further restrictions on the harvest of sciaenid resources in order to manage and conserve them for optimum yields.

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